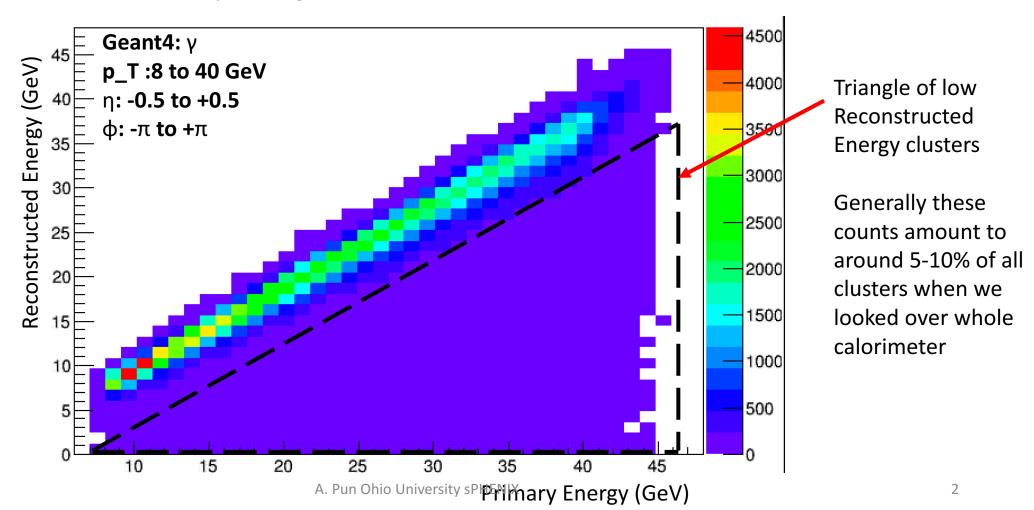
Low Reconstructed Energy EM Calorimeter Cluster Studies

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Ohio University



Truth Energy vs Reco Energy

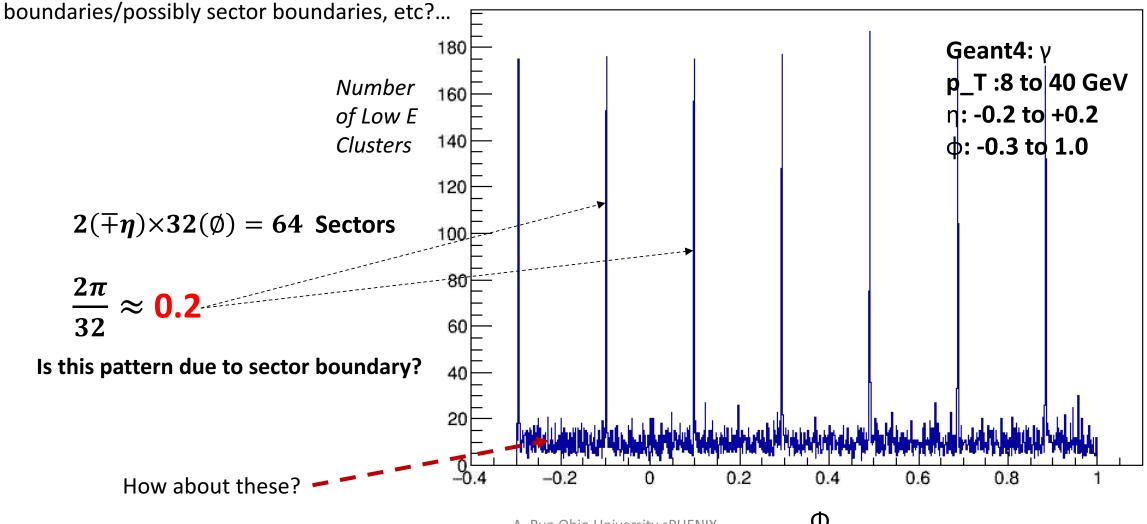
- -Along with our studies of EMCal clustering algorithms, we've been generating some general performance plots.
- -Before we were focused on cluster splitting performance, mostly with π^0
- -Saw these low Ereco clusters as soon as we ran modest γ statistics (since ~December): for all clustering algorithms, all simulation conditions (HIJING embed, particle gun, etc...)



Pattern of low reconstructed clusters in phi

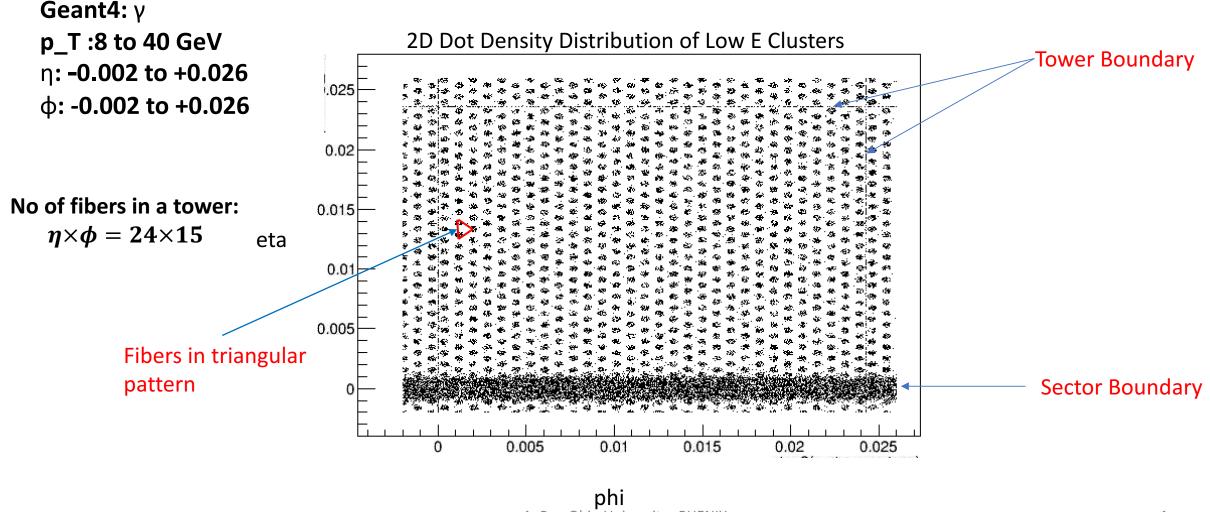
-We've been focused on classifying where these low E clusters originate.

-Various "large" geometric patterns were visible with different views, some that matched with tower

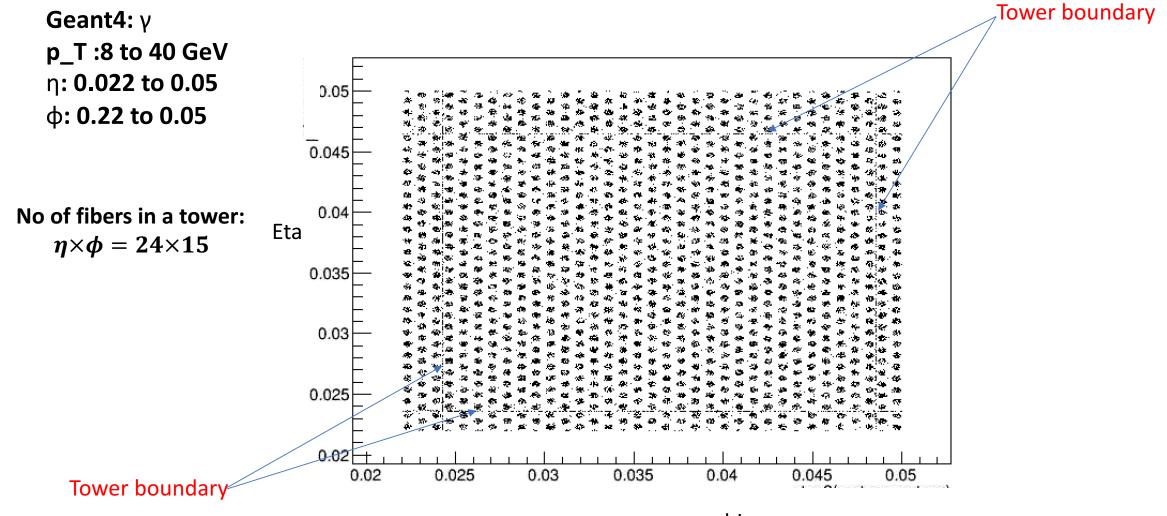


Patterns of low reconstructed energy cluster in a tower

- -Much larger density of statistics revealed fiber pattern
- -Confirmed from rudimentary understanding of 2D spacal geometry construction

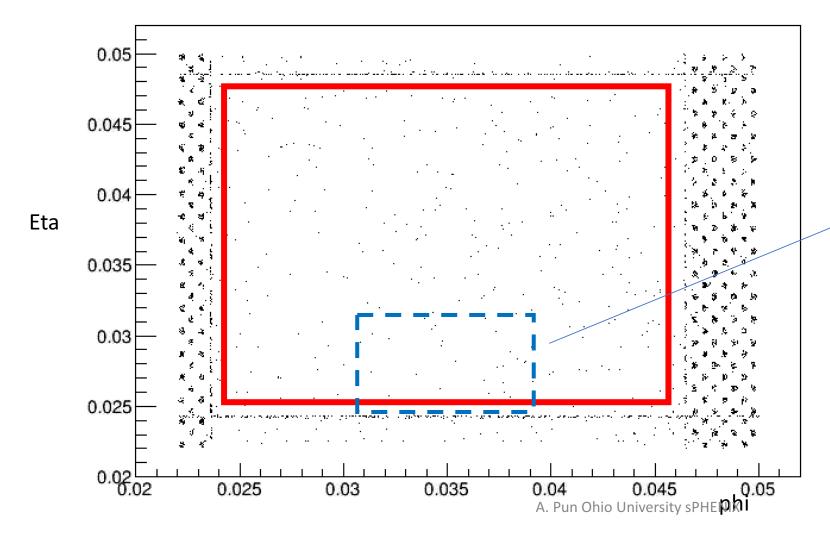


Patterns of low reconstructed energy cluster in a tower



Exclusion of Photons Hitting Geometric Locations of Fibers

- -Developed simple algorithm to exclude photons which it fiber locations
- -See how/performance changes
- -For plots that follow, focus on a **single tower** at $[\eta, \phi] \approx [0.03, 0.03]$ Some Low E Clusters still remain



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Zoom in without any clusters excluded --see next slide

Zoom in: Low E Cluster Locations

-Some Low E clusters not pointing at fiber locations, these remain after geometrical exclusion cuts applied to performance plots that follow

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Fiber locations

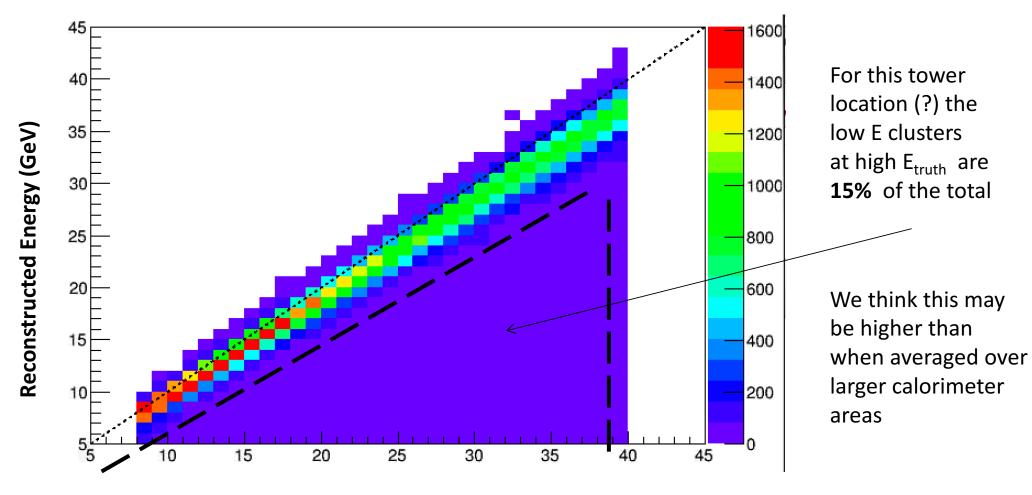
Clusters over one tower (without cut)

Geant4: γ

p_T :8 to 40 GeV

η: 0.025 to 0.047

φ: 0.025 to 0.047



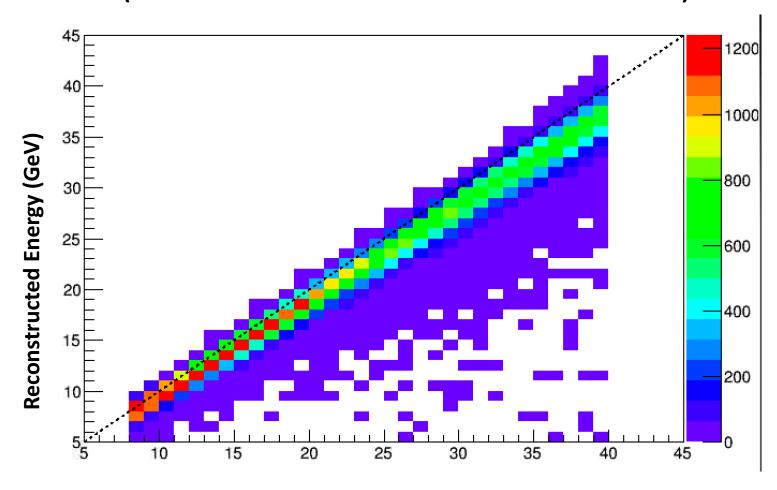
Cluster over one tower (with fiber exclusion cut)

Geant4: γ

p_T :8 to 40 GeV

η: **0.025 to 0.047**

φ: 0.025 to 0.047

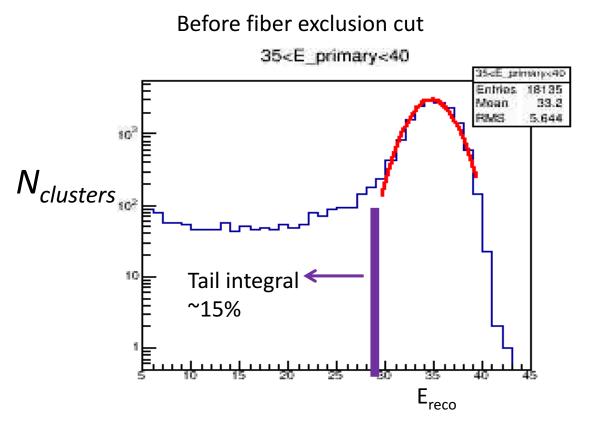


At High Etruth after the cut the remaining clusters are about 1.5%

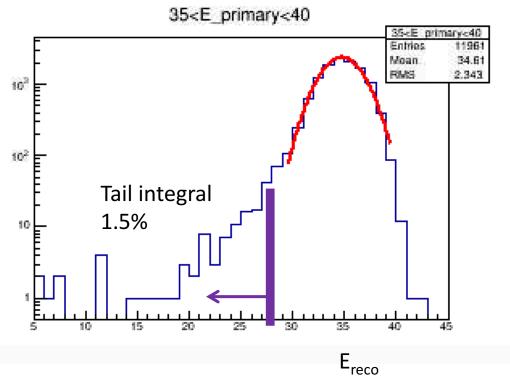
Lower at low pt

Low E cluster E_{reco} Distribution at High E_{γ}

-Truth photons between 35-40 GeV

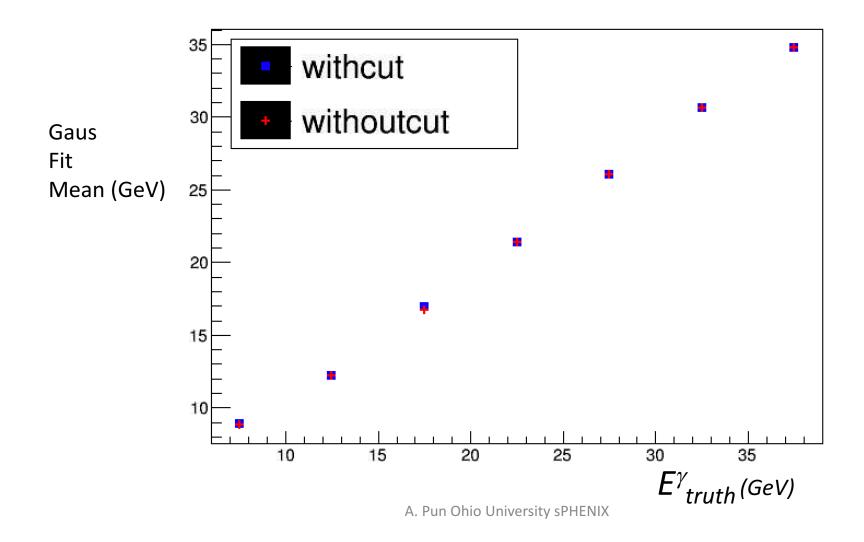


With cut



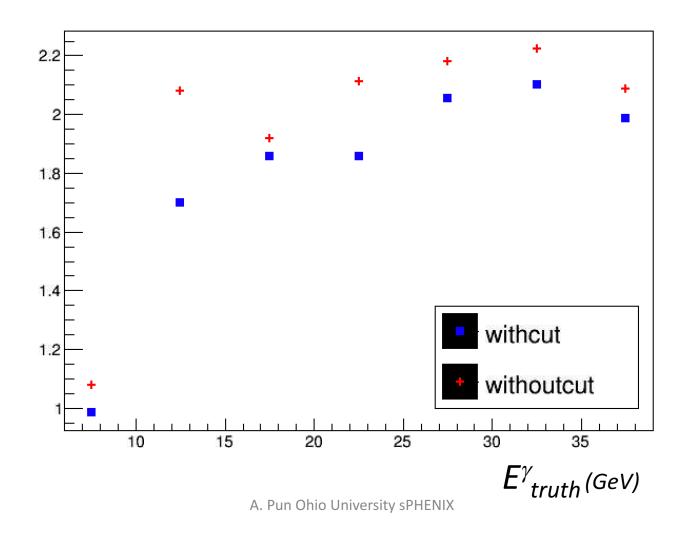
Fit mean Cut vs No Cut

-Mean in peak area is hardly affected



Fit sigma

-Small change in Fit Sigma with and without cut



Conclusions Outlook

- Most low E cluster seem to be due to fiber channeling
- Will expand study to see effect of tower sector borders